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# Factors Affecting Nutritional Adequacy Among Single Elderly Women

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Data from the 1994-96 Continuing Survey of Food Intakes by Individuals and the Diet and Health Knowledge Survey were used to assess the relative importance of factors associated with the quality of the diet of single women age 65 and older. Findings indicated that higher levels of nutritional adequacy were associated with Midwest residence, daily intake of a multivitamin/multimineral, higher levels of income, and the presence of circulatory disease. Lower levels of nutritional adequacy were associated with employment, receipt of food stamps, and rural residence. Results confirm the importance of providing healthful meal options to single elderly females who may be faced with fewer financial resources, reduced mobility, or higher costs associated with obtaining food.

**N**utritional adequacy among the elderly interests an aging U.S. population. In 1996, 12 percent of Americans were over age 65. By 2050, this elderly population is projected to more than double as members of the large baby-boom generation reach their elder years. Within this population, the fastest growing segment is expected to be those over age 85 (U.S. Department of Commerce, 1995).

For elderly individuals, inadequate nutrition can increase the incidence and severity of disease and also hasten loss of independence. But, the ability to choose a diet with sufficient quality and variety to meet daily nutrient needs may be affected adversely by the pathological, physiological, economical, and social factors that accompany aging. Reduced physical activity and lean body mass decrease requirements for food energy and increase the need for nutrient-dense foods (Haller, 1999). Gradual loss of health due to the effects of chronic diseases, such as arthritis or diabetes,

can impair the ability to obtain, prepare, and enjoy nutritious foods (Hendy, Nelson, & Greco, 1998). Quandt and Chao (2000) note that women, more so than men, report chronic problems with oral health and digestion, the need for special diets, diseases interfering with eating, and anemia.

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## Background

Lower levels of economic resources are associated with a greater risk of experiencing hunger and food insufficiency (Brown, 1987; Sahyoun & Basiotis, 2001). Quandt and Rao (1999) found that having an income less than 150 percent of the poverty level was a relatively strong predictor of food insecurity for Appalachian Kentucky residents age 65 and older. Hendy et al. (1998) noted that food cost was frequently mentioned as a barrier to obtaining adequate nutrition for rural elderly in the Eastern United States. Low economic resources can also affect the quantity and quality of food purchased, especially if an

increasing portion of the budget must be devoted to health care and prescription medications (Quinn, Johnson, Poon, Martin, & Nickols-Richardson, 1997).

While assistance is available through the U.S. Department of Agriculture's (USDA) Food Stamp Program to help the economically disadvantaged, concern exists that all those who are eligible do not participate and that benefit levels are low, compared with need (Shotland & Loonin, 1988). Some research has suggested that it costs more to eat a more healthful diet (Blaylock, Smallwood, Kassel, Variyam, & Aldrich, 1999); thus, low income can restrict not just the quantity but the nutritional quality of food purchased as well. Low income can also reduce consumers' ability to substitute market-produced meals for home-cooked versions as their desire and ability to shop and prepare meals decline.

Lower levels of education have been associated with inadequate nutritional intake in the elderly (Bianchetti, Rozzini, Carabellese, Zanetti, & Trabucchi, 1990; Dewitt, Douglas, & Matre, 1989). Nutrition knowledge has been found to have a weak, but positive, association with diet adequacy (Howard, Gates, Ellersieck, & Dowdy, 1998).

Schoenberg (2000) identified four "pathways" of nutritional risk for rural Black elderly: (1) changes in the physical and social importance of food, (2) lack of access to necessary resources, (3) increased physical limitations, and (4) misinformation about diet and nutrition. Lee, Templeton, Marlette, Walker, and Fahm (1998) discovered nutritional deficiencies in food energy, dietary fiber, and calcium among southern Black rural elderly. Diet variety appears to be lower for Blacks, compared with

other racial groups (Dewitt et al., 1989). In addition, Blacks are also more likely than Whites to have inadequate nutritional intake because of weight changes, illnesses, and oral problems that interfere with appetite and eating (Nickols-Richardson, Johnson, Poon, & Martin, 1996).

Loneliness due to death of spouse or friends can diminish the social reasons for, and pleasures associated with, eating (Shifflett & McIntosh, 1983; Walker & Beauchene, 1991). Eating regular meals and having an adequate diet have been found to depend, at least in part, on eating with others (Doan, 1990; Shifflett & McIntosh, 1983; Walker & Beauchene, 1991). Having few shared meals has been associated with higher levels of nutritional risk among rural elders in eastern Pennsylvania (Hendy et al., 1998) and with higher risk of food insecurity in rural Appalachia (Quandt & Rao, 1999). Fewer than a third of a nationally representative sample of elders experiencing food insufficiency were married, compared with more than half of those consuming a sufficient diet (Sahyoun & Basiotis, 2001).

Vitamin and mineral supplementation can offset some of the nutritional deficiencies in the elderly. A study of healthy, independent-living Canadians age 65 to 74 revealed that vitamin C supplements were used most often by both genders, but about three times as many women, compared with men, took a calcium supplement. In general, use of supplements significantly increased nutrient intake; and the risks for deficiency were eliminated for vitamin A, vitamin B<sub>12</sub>, folacin, and zinc (Donald et al., 1992).

This current study uses nationally representative data on single women age 65 and older from the 1994-96 Continuing Survey of Food Intakes by

Individuals (CSFII) and the Diet and Health Knowledge Survey (DHKS) conducted by USDA. Single women are of interest because the incidence of food insufficiency is relatively greater for the single elderly population (Sahyoun & Basiotis, 2001). They are also of interest because of their generally longer lifespans and consequently their prolonged risk of experiencing the pathological, physiological, economical, and social losses associated with poorer diet quality. In addition, women's longer average lifespan means that they are more likely to experience the life changes associated with a decrease in the quantity and quality of food intake (Nickols-Richardson et al., 1996; Quandt & Chao, 2000).

Research indicates that health problems related to inadequate nutrition are more prevalent in rural areas (Quandt & Chao, 2000; Schoenberg, 2000; Shotland & Loonin, 1988). Rural residents also mention transportation to and from food markets as a structural barrier to obtaining adequate food (Hendy et al., 1998; Lee et al., 1998; Wallace, Pascarella, & Campanella-Voica, 1997). Consequently, the effect of rural residence on single elderly women achieving adequate nutrition is considered in this research.

This study evaluates nutrient intake among single elderly women residing in rural and nonrural areas and examines the relative importance of single elderly women's resources, health status, attitudes, and practices related to food procurement and processing, as well as demographic characteristics in achieving adequate nutrition.

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## Method

### Data and Sample

The CSFII 1994-96 is a nationally representative sample of individuals of all ages living in the United States. Information regarding food and nutrient intakes of each respondent was gathered over 2 nonconsecutive days by using dietary recalls. Individuals age 20 and older also completed the DHKS, which contains information regarding the dietary health knowledge and attitudes of each individual. Included are questions about the knowledge of specific health risks associated with foods, personal health information, and the frequency of use of information on food labels. The DHKS sample consists of 5,765 respondents, from which 732 single women age 65 and older residing in rural (n=218) and nonrural (n=514) areas were selected for this study.

The method used to collect the dietary recall information in these surveys may lead to underreporting, particularly among older participants. It could also place some participants' nutritional status below the U.S. Recommended Dietary Allowance (RDA) threshold for one or more of the specific components of nutritional adequacy considered in this study (Dixon, Cronin, & Krebs-Smith, 2001). Unfortunately, it is not possible to ascertain the extent to which underreporting might be a problem for the sample used in this study. Thus, the possibility of underreporting is simply acknowledged as a limitation of these data.

### Conceptual Framework

The Deacon and Firebaugh (1988) systems model of resource management provides the basic conceptual framework used in this study. According to this model, through the managerial actions of planning and implementing, resources are transformed in

ways that meet value-based goals. In the transformation process, constraints and facilitating conditions can be present. Constraints limit means of reaching a goal or restrict access to or use of resources. Facilitating conditions, in contrast, ease the process of goal attainment.

When this conceptual framework is applied to the current study, the goal to be met is obtaining adequate nutrition—defined as intake of given nutrients that meet or exceed the RDAs. Resources consist of level of education, nutrition knowledge, income (measured as a percentage of the poverty level), and receipt of food stamps. Attitudes and behavior related to food procurement and preparation comprise the managerial actions of planning and implementing. Several factors could help or constrain obtaining adequate nutrition. For example, diet restrictions and disease can constrain food choices; work commitments can constrain time for food shopping and preparation; rural residence can limit access to less expensive, higher quality foods, which raises the costs associated with obtaining adequate nutrition. Taking a daily multivitamin/multimineral would facilitate meeting the RDAs for vitamins and minerals. Other variables in the conceptual framework are age, race, and region of residence, which enter the model as controls.

### Empirical Model

To ascertain the importance of the factors considered in this study, we used an ordinary least squares regression to compute standardized betas:

$$\text{RDA index} = \alpha + \Sigma\beta_{ii} \text{ resources} + \Sigma\beta_{ii} \text{ management} + \Sigma\beta_{ii} \text{ constraining factors} + \Sigma\beta_{ii} \text{ facilitating factors} + \epsilon$$

An RDA index was constructed to measure the degree to which study

participants met RDA requirements for food energy, protein, and 14 essential vitamins and minerals. The threshold level for each component of the index is based on the 1989 RDAs (National Academy of Sciences, 1989). These RDAs were used rather than the recently published Dietary Reference Intakes (DRIs) because the RDAs were current at the time the data used in this study were collected.

Resources consisted of measures of both general and nutrition-specific knowledge and economic resources. General knowledge was measured by a set of categorical variables indicating highest grade completed. Nutrition-specific knowledge was measured by the number of items from a total of 13 that a study participant answered correctly on a test of nutrition knowledge administered in the original survey. Economic resources consisted of income, which was measured as a percentage of poverty and receipt of food stamps.

Attitudes and behavior related to food procurement and preparation were indicative of plans and actions associated with achieving nutritional adequacy (management). Whereas attitudes were indicated by the importance of nutrition, proper food storage, ease of preparation, and taste, behavior was denoted by study participants' use of nutrition labels and whether they had the main responsibility for preparing meals.

Constraints on food choices were measured by the presence of diet restrictions and diseases prevalent among the elderly. These consisted of lowfat, low-calorie, low-sodium, high-fiber, or diabetic diets and circulatory disease, diabetes, cancer, or osteoporosis. Work was considered a time constraint to shop for and prepare food. Although incidence of employment among the elderly is low,

women often continue working past age 65 (Herz, 1988). This trend is expected to continue as members of the baby-boom generation reach their elder years (Purcell, 2000).

Rural versus nonrural (urban and suburban) residence also was included in the empirical model, as were multivitamin/multimineral intake, age, race, and region of residence.

## Results

Results indicated that the rural and nonrural samples were similar (table 1). Respondents typically had less than a high school education (40 percent for the total sample, 45 percent for rural residents, and 37 percent for nonrural residents). Average age of the sample was close to 74 years. The largest proportion of rural residents lived in the South (43 percent), while about an equal proportion of nonrural residents lived in the Northeast, South, or Midwest (28, 28, and 27 percent, respectively). Close to 90 percent of both rural and nonrural respondents were White, did not receive food stamps, and were not employed.

Regarding attitudes and behavior related to food procurement and preparation, close to three-fourths of both rural and nonrural respondents indicated that nutrition, taste, and food not spoiling were very important. A little over half of each group did not consider easy preparation to be very important, most did not use nutrition labels, and about 90 percent of each group had primary responsibility for preparing meals. Slightly less than half (44 to 47 percent) of each group took a daily multivitamin/multimineral supplement. Study participants seemed to have adequate but relatively low economic resources: income was, on average, near 180 percent of the poverty level. Each group answered

**Table 1. Descriptive statistics for single elderly women**

Variables	Total <sup>1</sup>	Rural <sup>1</sup>	Nonrural <sup>1</sup>
<i>Mean</i>			
Continuous			
Nutrition knowledge test (number correct of a possible 13)	8.0	8.2	7.9
Income (% of poverty level)	184.9	182.4	185.9
Age (years)	73.6	74.7	73.2
<i>Percent</i>			
Categorical			
Education			
Less than high school	40	45	37
High school	30	26	32
Some college	17	14	18
College	13	15	13
Race			
White	85	94.5	81
Black	13	5	16
Asian and Pacific Islander	0.5	0	1
Other <sup>2</sup>	1.5	0.5	3
Region			
Northeast	23	11	28
South	33	43	28
Midwest	30	38	27
West	14	8	17
Employment			
Full-time	2	1	2
Part-time	8	11	7
Not working	90	88	91
Receipt of food stamps			
Yes	8	5	9
No	92	95	91
Importance of nutrition			
Very important	74	75	73
All other responses <sup>3</sup>	26	25	27
Importance of taste			
Very important	86	87	85
All other responses <sup>3</sup>	14	13	15
Importance of food not spoiling			
Very important	73	78	70
All other responses <sup>3</sup>	27	22	30
Importance of easy preparation of food			
Very important	42	39	43
All other responses <sup>3</sup>	58	61	57
Use nutrition labels			
Use often (always)	34	35	38
All other responses <sup>4</sup>	66	65	62
Main responsibility for meals			
Yes	90	91	90
No	10	9	10
Take vitamins daily			
Yes	46	44	47
No	54	56	53

<sup>1</sup>Sample size: total = 732, rural = 218, and nonrural = 514.

<sup>2</sup>Native American, Alaskan Native, and other races.

<sup>3</sup>Somewhat important, not too important, not at all important, don't know.

<sup>4</sup>Sometimes, rarely, never.

**Table 2. Components of the RDA Index for single elderly women**

Nutrient percent RDA	Total <sup>1</sup>		Rural <sup>1</sup>		Nonrural <sup>1</sup>	
	Mean percent of RDA	Percent of sample meeting RDA	Mean percent of RDA	Percent of sample meeting RDA	Mean percent of RDA	Percent of sample meeting RDA
Food energy (kcal)	84	27	84	27	84	27
Protein (g)	148	69	146	65	149	71
Vitamin A ( $\mu$ g)	165	48	143	40	175	51
Vitamin E (mg)	86	28	84	28	86	28
Vitamin C (mg)	167	57	135	50	180	61
Thiamin (mg)	138	65	142	64	137	66
Riboflavin (mg)	145	66	144	64	145	67
Niacin (mg)	146	68	148	65	146	70
Vitamin B <sub>6</sub> (mg)	102	42	99	39	103	44
Folate ( $\mu$ g)	158	60	153	56	161	61
Vitamin B <sub>12</sub> ( $\mu$ g)	287	71	281	69	290	72
Calcium (mg)	90	36	85	33	92	38
Phosphorus (mg)	138	71	137	69	139	72
Magnesium (mg)	99	34	97	33	100	35
Iron (mg)	140	60	143	62	138	60
Zinc (mg)	76	20	78	21	75	21
<b>RDA Index (of a possible 16)</b>	<b>8.3</b>		<b>7.9</b>		<b>8.4</b>	

<sup>1</sup>Sample size: total = 732, rural = 218, and nonrural = 514.

Note: Means under 100 percent indicate underconsumption according to the RDA; means at or above 100 percent indicate adequate consumption. Underreporting, if present, would understate the true value.

**Rural residents had lower average nutrient consumption levels, measured as a percentage of RDA, for protein, seven vitamins (A, C, E, B<sub>6</sub>, B<sub>12</sub>, riboflavin, and folate) and three minerals (calcium, phosphorus, and magnesium).**

8 of the 13 nutrition knowledge items correctly.

Nutrient scores as a percentage of the RDAs were lower for rural residents, compared with those of nonrural residents (table 2). Rural residents had lower average nutrient consumption levels, measured as a percentage of RDA, for protein, seven vitamins (A, C, E, B<sub>6</sub>, B<sub>12</sub>, riboflavin, and folate) and three minerals (calcium, phosphorus, and magnesium). The proportion of the rural sample that met the RDA for specific nutrients lagged behind that of the nonrural sample for protein and the same vitamins (except vitamin E) and minerals, plus thiamin and niacin. For many of these nutrients, however, the differences between rural and nonrural residents were rather small in practical terms. The average score on the RDA index was lower for rural residents,

compared with the average score for nonrural residents: 7.9 vs. 8.4 (of a possible 16). However, the general pattern of average nutrient consumption levels, measured as a percentage of the RDAs, was the same for both rural and nonrural residents. For example, the percentage of the RDA for protein for both groups was over 100, while the percentage for vitamin E was less than 100 for both groups.

A slightly higher proportion of nonrural residents, than their rural counterparts, reported low-calorie, low-sodium, or high-fiber diet restrictions, whereas, an equal proportion of rural and nonrural residents reported having a lowfat or diabetic diet (table 3). A larger proportion of rural residents had been diagnosed as having heart disease, cancer, or osteoporosis, while a slightly larger proportion of nonrural

**Table 3. Diet and disease restrictions for single elderly women**

Variable	Total <sup>1</sup>	Rural <sup>1</sup>	Nonrural <sup>1</sup>
		<i>Percent</i>	
Diet restrictions	26	23	26
Lowfat	4	4	4
Low calorie	14	12	14
Low sodium	9	7	10
High fiber	3	1	3
Diabetic	7	7	7
Diagnosed diseases			
Circulatory	69	71	68
High blood pressure	51	51	51
Heart disease	23	27	21
High blood cholesterol	30	29	31
Stroke	7	6	8
Diabetes	14	14	15
Cancer	12	17	9
Osteoporosis	13	13	12

<sup>1</sup>Sample size: total = 732, rural = 218, and nonrural = 514.

residents reported diagnosis of high blood cholesterol, stroke, or diabetes. Both rural and nonrural residents had equal rates of diagnosed high blood pressure (51 percent).

Results of the multivariate analysis indicate that economic resources, and various constraining and facilitating conditions were significant in explaining variation in nutritional adequacy among single women age 65 and older (table 4). In rank order of importance, the significant factors were Midwest residence, taking a daily multivitamin/multimineral, employment (full or part time), income as a percent of poverty, presence of circulatory disease, receipt of food stamps, and rural residence. In terms of direction of association, Midwest residence, taking a daily multivitamin/multimineral, higher levels of income, and presence of circulatory disease were associated with higher levels of nutritional adequacy. Employment, receiving food stamps, and rural residence, however, were associated with lower levels of nutritional adequacy.

**Study findings indicate that single elderly women's economic resources are more important than knowledge resources in attaining adequate nutrition.**

## Discussion and Implications

Study findings indicate that single elderly women's economic resources are more important than knowledge resources in attaining adequate nutrition. The positive relationship between income and nutrition adequacy is consistent with previous research (Brown, 1987; Sahyoun & Basiotis, 2001; Hendy et al., 1998; Quandt & Rao, 1999; Quinn et al., 1997) and with the idea that a higher quality diet costs more (Blaylock et al., 1999). It is reasonable to expect that those with limited resources would benefit from the Federal Food Stamp Program. Thus, the negative relationship between receipt of food stamps and nutrition adequacy is contrary to what would be expected. It could be that, as Shotland and Loonin (1988) contend, benefit levels are too low to really meet the need. It certainly appears that, for whatever reason, food stamp participants in this sample still do not acquire the quantity and quality of food necessary to get adequate

nutrition. Further research is needed to examine why this is the case.

As might be expected, nutritional adequacy is improved by taking supplemental multivitamins/multiminerals. Among disease diagnoses, the strong and significant effect of circulatory disease upon improved diet may reflect the enhanced potential benefit from changing behavior in the present, in contrast to the nonsignificant (and negative) effect of a cancer diagnosis on diet quality. Diet restrictions and disease diagnoses other than circulatory disease were not significant factors in this study.

Rural and lower income single elderly women were significantly less likely to eat a nutritionally adequate diet than were their nonrural and higher income counterparts. Lack of nearby supermarkets with an adequate selection of healthful foods or access to support programs such as Meals-on-Wheels may also serve as important constraints to healthful eating for the rural elderly. Insufficient funds constrain purchase of more foods and better quality foods. Single elderly women who work are less likely to eat a nutritious diet—perhaps because of constraints on time and lower levels of economic resources. It is not known whether employment of survey respondents is by choice or necessity. This issue warrants further research given expectations that aging baby boomers will maintain some attachment to the labor market as they enter their elder years. The negative relationship between receiving food stamps and meeting the RDAs may be attributed to low levels of accumulated financial resources—since eligibility is a function of both income and wealth. It also may reflect the quality of food obtained.

**Table 4. Regression results, RDA index value for single elderly women**

Variables	Parameter estimate	Standardized estimate	Rank order
<b>Resources</b>			
Education (reference category < high school)			
High school	-0.5051	-0.0496	
Some college	0.8317	0.0661	
College	0.6752	0.0494	
Nutrition knowledge test score	0.0095	0.0051	
Income (% of poverty)	0.0044*	0.0828	4
Food stamp recipient	-1.2451*	-0.0708	6
<b>Management</b>			
<i>Attitudes</i>			
Importance when selecting foods			
Nutrition	0.0683	0.0064	
Food not spoiling	0.2239	0.0213	
Ease of preparation	-0.2048	-0.0216	
Taste	-0.1951	-0.0146	
<i>Behavior</i>			
Always use nutrition labels	-0.3505	-0.0363	
Responsible for preparing meals	0.0483	0.0031	
<i>Constraints/Facilitators</i>			
Diet restrictions			
Lowfat	-0.0541	-0.0040	
Low-calorie	0.1590	0.0069	
Low-sodium	-1.0314	-0.0640	
High-fiber	1.8519	0.0630	
Diabetic	0.5415	0.0300	
Diagnosed with disease			
Circulatory	0.7937**	0.0788	5
Diabetes	0.5065	0.0380	
Cancer	-0.5059	-0.0347	
Osteoporosis	-0.2433	-0.0173	
Work (full time or part time)	-1.4574**	-0.0945	3
Rural	-0.7232*	-0.0707	7
Take daily vitamins	0.9385**	0.1000	2
<b>Control variables</b>			
Age	-0.0235	-0.0335	
Black	-0.6682	-0.0480	
Region (reference=South)			
Northeast	-0.1499	-0.0135	
Midwest	1.2323**	0.1210	1
West	0.4313	0.0319	
Intercept	8.3533**	R <sup>2</sup> =0.0916	

\*Significant at 0.10 level.

\*\*Significant at 0.05 level.

\*\*\*Significant at 0.001 level.

n=732.

In 1994, Midwest consumers faced food prices that were 7.7 percent lower than those in the Northeast, 3.9 percent lower than those in the West, and less than 1 percent lower than those in the South (U.S. Department of Labor, 2002). This may help explain the strong relationship between Midwest residence and meeting the RDAs. The availability of nutrient-dense foods, proximity to local farmers' markets, as well as cultural and social differences within the region, also may help account for more nutritious diets.

Our study suggests that single elderly women can be found on at least one of the four "pathways" to nutritional inadequacy—namely lack of access to necessary resources—as identified by Schoenberg (2000). Results confirm the importance of providing healthful meal options for single elderly women who face fewer financial resources, reduced mobility, or higher costs associated with obtaining food.

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